

CASE STUDY

GLOBAL ENVIRONMENTAL CHANGE

How have people changed the atmosphere?

Some people fear that global warming might cause an increase in violent weather.



As you have read in other units, many human activities harm the environment. Among these are the burning of fossil fuels and the use of chemicals such as chlorofluorocarbons (CFCs) in aerosol cans. Many scientists fear these activities are changing the environment in ways that affect the whole world.

Damage to the Environment

Scientists believe that the use of fossil fuels has begun to heat the climate, and the use of chemicals has damaged the ozone layer.

GLOBAL WARMING The burning of fossil fuels releases carbon dioxide (CO₂) into the atmosphere. Carbon dioxide is one of the greenhouse gases—gases that trap the sun's heat. Greenhouse gases serve the useful function of preventing the escape of all the sun's energy into space. Without them, the earth would be cold and lifeless.

Some scientists fear that the atmosphere now has too many greenhouse gases. CO₂ emissions have increased 50 percent since the 1970s.

Scientists believe that the increase in CO₂ levels causes the atmosphere to trap too much heat, so temperatures have been gradually rising.

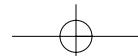
Many people disagree with the theory of global warming. Some say the temperature rise may be due to natural processes. Others say that temperatures have not gone up, that they fall within a normal range.

OZONE HOLE Another change is damage to the ozone layer, which exists high in the atmosphere. It absorbs most of the sun's damaging ultraviolet rays. In the 1970s, scientists discovered a thinning of the ozone layer over Antarctica, often called a hole in the ozone layer. Chemicals such as the chlorine found in CFCs react with ozone and destroy it. Many governments have restricted the use of such chemicals, but others have delayed passing such laws because they are costly for industry.

Looking Toward the Future

Scientists fear that many problems may result from these changes to the environment. Because of that, many people and nations around the world are trying to halt the damage before it is too late.

LONG-TERM EFFECTS One fear about global warming is that even small temperature increases could melt the world's ice caps. This would cause a rise in sea levels that might swamp coastal cities and islands. For example, the low islands of Oceania might disappear.



Some people predict that global warming might change patterns of evaporation and precipitation. This could make violent storms such as typhoons and droughts more common. The location of climate zones and agricultural regions might shift, upsetting the world's economy.

SEE

PRIMARY SOURCE D

People worry about the ozone layer hole because more ultraviolet rays will reach earth. Ultraviolet rays are linked to such problems as skin cancer, eye damage, and crop damage. Because it lies close to Antarctica, New Zealand may be at higher risk than other regions.

TAKING ACTION In 1992, the UN held the Earth Summit, a conference to discuss ways to pursue economic development while protecting the environment. Representatives of 178 nations attended.

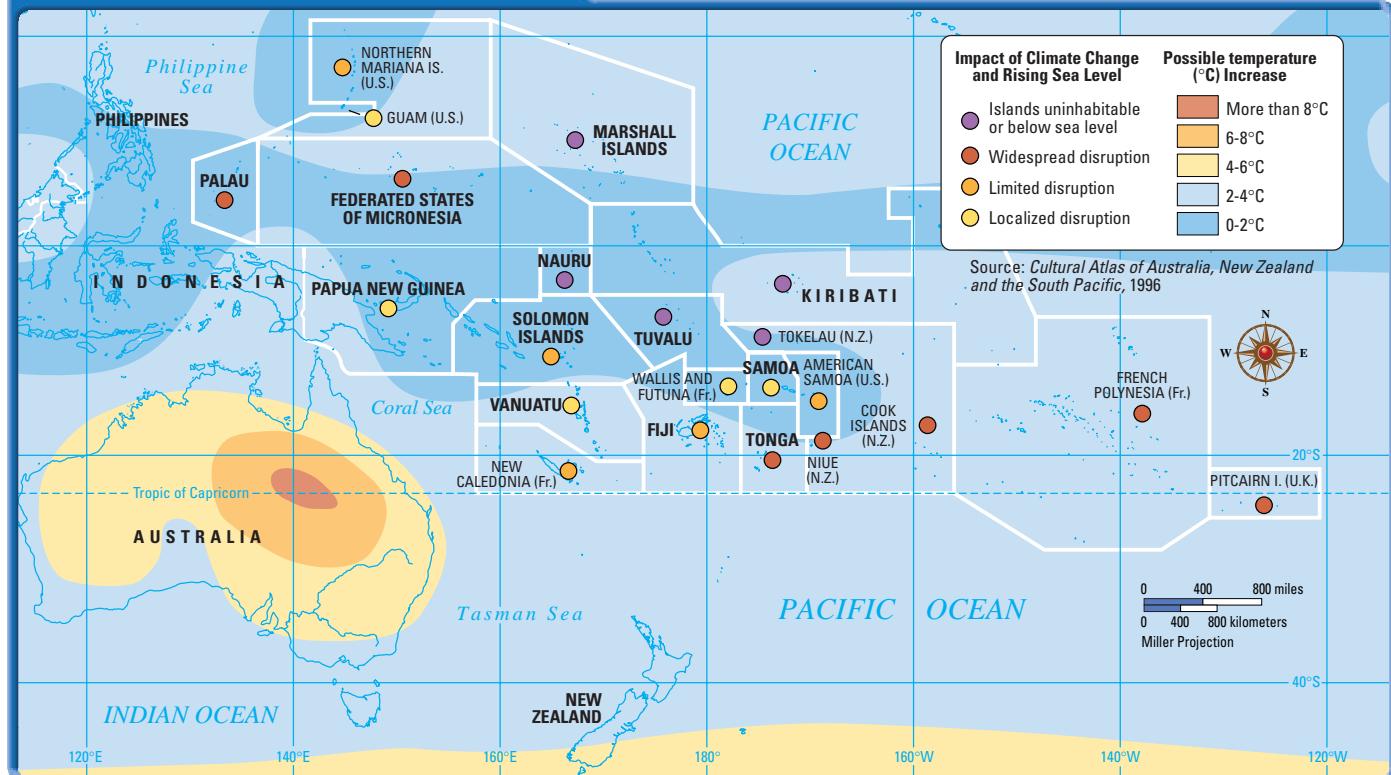
SEE

PRIMARY SOURCE A

In 1997, the UN held a convention in Kyoto, Japan, to discuss climate change. The conference wrote the Kyoto Protocol, guidelines for developed countries to reduce greenhouse gas emissions. In time, 165 nations signed the treaty. The United States signed the treaty, but the Senate didn't ratify it—fearing that the guidelines might harm U.S. businesses.

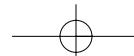
On the next two pages are primary sources expressing different views about environmental problems. Use them to form your own opinion.

Predicted Impact of Global Warming



SKILLBUILDER: Interpreting Maps

- PLACE** Where are the greatest temperature increases expected to occur?
- PLACE** What places in Oceania are expected to experience the least disruption?



CASE STUDY

PROJECT

Political Cartoon

Primary sources A to E on these two pages present differing opinions on global environmental change. Use these sources and your own research to create a political cartoon expressing your opinion. You might use the Internet and the library for research.



RESEARCH LINKS
CLASSZONE.COM

Suggested Steps

1. Use the sources here and your own research to decide if you believe that global warming and the ozone hole are problems.
2. Draw a pencil sketch of a cartoon expressing your opinion about global environmental change. As you decide what to draw, consider the following questions.
 - Do you think that the theories about environmental change are wrong? If so, why are people so concerned about the issue?
 - Do you think environmental change poses a threat to the world's climate? If so, what should be done?

3. Show the sketch to a friend to see if you have conveyed your point. Use your friend's feedback to make your cartoon more effective.
4. Create your final cartoon. You may wish to draw it lightly in pencil and then ink over the pencil marks. Post the cartoon in class.

Materials and Supplies

- Samples of political cartoons
- Drawing paper
- Pencils and erasers
- Felt-tip markers
- Computer
- Internet access

PRIMARY SOURCE A

Educational Pamphlet In 1994, the United Nations Environment Programme and the World Meteorological Organization published a pamphlet called *Beginners Guide to the Convention to help people understand the Kyoto Protocol and the reasons for it*.

Human beings seem to be changing the global climate. The results are uncertain, but if current predictions prove correct, the climatic changes over the coming century will be larger than any since the dawn of human civilization.

The principal change to date is in the earth's atmosphere. . . . We have changed, and are continuing to change, the balance of gases that form the atmosphere. This is especially true of such key "greenhouse gases" as carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). (Water vapour is the most important greenhouse gas, but human activities do not affect it directly.) . . . Greenhouse gases are vital because they act like a blanket around the earth. Without this natural blanket the earth's surface would be some 30°C colder than it is today.

The problem is that human activity is making the blanket "thicker." . . . The most direct result, says the scientific consensus, is likely to be a "global warming" of 1.5 to 4.5°C over the next 100 years.

PRIMARY SOURCE B

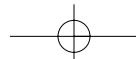
Political Commentary The American Policy Center is a conservative group that wants to promote free enterprise and reduce government regulations. It opposed the Kyoto Protocol and published the article "There is No Global Warming."

There is no global warming. Period. You can't find a real scientist anywhere in the world who can look you in the eye and, without hesitation, . . . say "yes, global warming is with us."

There is no evidence whatsoever to support such claims. Anyone who tells you that scientific research shows warming trends . . . is wrong. There is no global warming.

Scientific research through U.S. Government satellite and balloon measurements shows that the temperature is actually cooling—very slightly—.037 degrees Celsius.

A little research into modern-day temperature trends bears this out. For example, in 1936 the Midwest of the United States experienced 49 consecutive days of temperatures over 90 degrees. There were another 49 consecutive days in 1955. But in 1992 there was only one day over 90 degrees and in 1997 only 5 days.



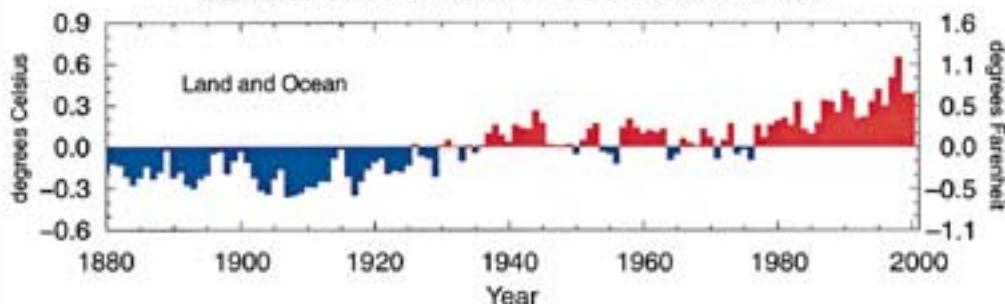
PRIMARY SOURCE C

Data The National Climatic Data Center collects data on temperature and precipitation. In the graph below, the line at zero represents the average annual world temperature for the period

1880 to 2000. The bars show how much the average temperatures for individual years were higher or lower than the average. Scientists use this graph to spot climate trends.

Annual Global Surface Mean Temperature Anomalies

National Climatic Data Center/NESDIS/NOAA



PRIMARY SOURCE D

News Article On October 10, 2000, the New York Times published the article "Record Ozone Hole Refuels Debate on Climate" by Andrew C. Revkin. The article appeared in the science section of the paper.

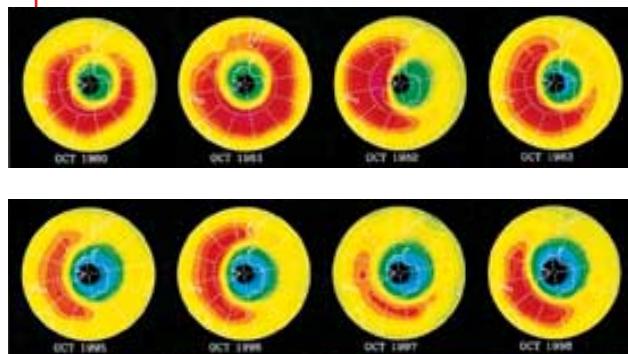
The hole that opens in the ozone layer over Antarctica each southern spring formed earlier and grew bigger this year than at any time since satellites have been monitoring the polar atmosphere, scientists have reported.

The finding renewed suspicions among atmospheric scientists that global warming could be indirectly abetting the chemical reactions that destroy ozone, but many still say the growth of the hole could also be the result of natural . . . variations in Antarctic weather and other conditions. . . .

The hole is closely watched because the stratosphere's . . . layer of ozone . . . absorbs ultraviolet rays, which could contribute to skin cancers and cataracts and threaten agriculture and ecosystems if they reached the surface.

PRIMARY SOURCE E

Satellite Images Satellites took these images of ozone over Antarctica. The color blue represents areas with an extremely low concentration of ozone, while red shows a high concentration.



PROJECT

CheckList

Have I . . .

- ✓ researched opinions on global environmental change?
- ✓ formed my own opinion based on evidence about the issue?
- ✓ created an interesting cartoon that clearly expresses that opinion?
- ✓ created a cartoon that is neat enough to print in a newspaper?